tion plays an important rôle in high-power work with the microscope no one will deny. This author gives it its true value in microscopic vision, connecting all vision together instead of making a violent change somewhere.

In this work the statement is frequently reiterated that the eye of the observer forms a part of the optical apparatus, being in this respect in refreshing contrast to those that ignore the eye in dealing with the microscope. The author takes up every other difficult question relating to the microscope, as angular and numerical aperture, dark-ground illumination, the production of critical images, the limitation of microscopic vision propounded by Helmholtz and others, and each subject is simplified.

With reference to the Helmholtz theory of the limitation of resolution in microscopic vision, the statement or formula of Helmholtz is cast in a form familiar at present in microscopical optics and is shown to be $0.6\,\lambda/\text{N.A.}$, that is, the wave-length of the light used multiplied by 0.6, and this divided by the numerical aperture (N.A.) of the objective will give the limits of visibility. Numerous examples are given showing that this theoretical limit is very close to the actual limit with the best modern microscopes as ordinarily used. The point is not yielded, however, without showing a possible escape from the apparent restrictions. In dealing with high magnifications he says:

> The three impediments to resolution just referred to are: (*a*) diffusion, (*b*) conspicuous antipoint and (*c*) obfuscation in the eye.

He shows that all these defects are directly referable to the contraction of the beam incident to high magnifications, and that the only way to escape these limitations is to increase the aperture or, as he puts it, "to open up the terminal beam." He then considers the method of Gordon by which the terminal beam is widely opened by means of a disc of ground glass placed at the level of the diaphragm in the Huygenian ocular, that is, at the level where the real image is formed. This real image is then observed by a second, low-power microscope. To avoid the obscurity given by the grain on the ground glass the latter is rotated.

It is stated that by this means Mr. Gordon has shown repeatedly before the Royal Microscopical Society objects under "magnifying powers of 10,000 diameters and over," the retinal image being free from obfuscation and conspicuous antipoint. To enforce the argument and to show the reader the appearance with and without the opening up of the terminal beam, Plate XVIII., with five photographs, is given, illustrating in the most striking manner the points mentioned in the text.

This book is beautifully printed and its numerous figures really illustrate the text. In a word it is the clearest and most authoritative exposition of the microscope and its accessories and the interpretation of microscopic appearances to be found in any single work. It is sincerely hoped that it will speedily find its way into the hands of teachers and advanced students.

S. H. G.

Selectionsprinzip und Probleme der Artbildung. Ein Handbuch des Darwinismus. Von Dr. LUDWIG PLATE. Dritte, sehr vermehrte Auflage, mit 60 Figuren im Text. Leipzig, Engelmann. 1908. Pp. viii + 498.

That Plate's work on the principle of selection and the problem of the origin of species should in eight years have passed through three editions is welcome evidence that the reading public appreciates a good biological treatise; that it should in the respective editions pass from 153 pages and 247 pages to over 500 pages with illustrations is evidence both of the great recent growth of contributions to the subject and of Plate's enterprise in following them up.

The principal additions to this last edition consist of a brief review of Darwinism, a discussion of Darwin's and de Vries's views of the rôle of individual variation; an extension of the section on "Sprungevolution"; a consideration of a new objection to Darwin's principle of selection, viz., that selection can not be demonstrated in detail; additional consideration of the forms of the struggle for

existence and selection; de Vries's mutation theory; a new section on "Heredity" (in former editions omitted, singularly enough, as a presupposition of selection); an extensive enlargement of the section on variation, and a thorough revision of the final chapter—"the applicability and limitations of the Darwinian and Lamarckian factors." Through these additions the book has been doubled in size and value.

The greatest interest naturally attaches to the author's position on the newer questions of the day relating to mutation and heredity—questions that were merely shaping themselves at the time the second edition was written, four or five years ago. In regard to the theory of saltation, which is considered historically in a thorough fashion, the author concludes that, on account of their rarity and their prevailingly pathological character, saltations have only the significance of exceptional phenomena not properly to be considered as playing the part of making variations that are, on account of their size, directly of selectional value.

As for the mutation theory, which the author treats quite separately from saltation, he concludes—after a valuable summary of de Vries's work—that it is a modified theory of selection from which the idea of the inheritance of somatic variations has been eliminated. At the outset Plate calls attention to the fact that de Vries has not only applied the name mutation in a new (and ill-defined) sense, but has used the term "fluctuating variability" in an opposite sense from Darwin; since for Darwin[1] fluctuating variability is the ordinary inheritable variability as opposed to "definite variability" resulting from direct action of changed conditions and commonly regarded as non-inheritable; while for de Vries fluctuations are due to variations in nutrition and so fall into Darwin's category of "definite variations." Using for the present de Vries's terminology, the type of mutation is that of *Œnothera lamarckiana*, in which a number of characters change simultaneously to produce each of the mutants. Unfortunately this type case is an exotic in Amsterdam, where its mutability was first discovered, is unknown in the wild state and is very probably a hybrid. In any case the proportion of mutants produced is small, they lack adaptive features, and, in general, mutation is a rare phenomenon. In consequence of all these reasons mutations can play little part in nature. Plate opposes the extension of the term mutation to cover saltations and fluctuations in Darwin's sense (the ordinary variation of single characters), and so leaves it reduced to its lowest limits and shorn of any great significance. This treatment strikes the reviewer as not altogether just. De Vries's theory deserves more credit at least for this that it stemmed the tide of exclusive attention to quantitative variation that was threatening to obliterate the study of the origin and inheritance of new characters; *i. e.*, variations of the qualitative order; it stimulated a study of the origin and inheritance of variations by the method of experiment.

The section on heredity contains two principal parts: The first deals with the inheritance of acquired characters, the second with Mendelism. As for the first the author accepts as demonstrated the inheritance of the effects of heat, light, etc., on insects, fishes and plants; he lays stress on the difference of pigmentation on the two sides of the flounder—a difference which, while associated with the different exposure to light of the two sides of the body in the adult, begins to appear before the young fish abandons its vertical attitude in the water. He regards as critical Semon's investigations upon the seedlings of sensitive plants which, without having experienced the alternation of daylight and darkness, nevertheless show an innate tendency to open their leaves for twelve hours and shut them (for sleep) during the alternate twelve hours. He cites the loss of pigmentation of cave animals as evidence of the transmission of a somatic character to the germ plasm, but fails (the reviewer believes) sufficiently to appreciate the evidence for an orthogenetic tendency in these cases toward loss of pigment.

[1] "Variation of Animals and Plants under Domestication," chapter XXVI., summary.

Some of the best evidence on the inheritance of acquired characters has been too recent, perhaps, for consideration in this edition. Unless we are much mistaken in the next edition this section will chronicle the greatest advances in the theory of evolution.

As for Mendelism the treatment given by Plate is all too brief, though appreciative. He entertains the view that the Mendelian result follows between closely related individuals but not between distinct species; between the latter the characters blend. This conclusion seems to the reviewer insufficiently founded; the cross between a goldfinch and a canary shows in the first generation no more blending of characters than that between two races of canaries. The method of inheritance probably depends less on the degree of relationship of the individuals crossed than upon the nature of the characters concerned.

Of the book as a whole one can speak only in praise. Notwithstanding its conservative attitude, it affords, in the reviewer's opinion, the best general résumé extant of modern evolutionary data and theories; there are other excellent résumés but, for the most part, now out of date. How quickly a book on this topic may become out of date is indicated by the growth of the bibliography in the successive editions of Plate's book. In the first edition there were about 210 titles; in the second, 260; and in the last 450. The new edition will be widely read, but it deserves the greater accessibility that an English translation would give. In any case it seems well adapted to hold its ground, for some time to come, as the standard treatise on Darwinism.

CHAS. B. DAVENPORT

The Fossil Turtles of North America. By OLIVER PERRY HAY. Carnegie Institution. Pp. 568, pls. 113. 1908.

The appearance of Dr. Hay's extensive and richly illustrated memoir upon the fossil turtles of North America will mark a new departure in the study of this important and interesting order of reptiles. A bulky volume of nearly six hundred pages and over one hundred plates, aside from the numerous text illustrations, it will enable the student, for the first time in many years, to understand and appreciate the material at his command, for there are few collections of extinct vertebrates in America which do not have some remains of turtles. We may now expect a rapid increase in our still very defective knowledge of these animals, since but very few of the 276 species described in the present work are completely known; indeed, much the larger part are yet imperfectly known. The author, after the examination of nearly all the types, as well as most of the known material in America, has systematized and correlated our present knowledge so that the work will serve as the basis of the literature for future studies.

The reviewer has read attentively the extended and detailed introductory parts of the volume on the structure, classification, geographical and geological distribution and evolution of the Testudinata, and for the most part has only commendation and approval. But he can not approve the classification that Dr. Hay adopts. The division of the order into two chief groups or suborders, the Athecæ and Thecophora, first proposed by Dollo and Cope, has been carried to an extreme by the author, in that he would have the former a primitive branch from the testudinate stem, arising in early Trias or late Permian, and all its aquatic adaptations and chelonid resemblances purely of parallel origin; an hypothesis difficult to accept. He assumes that the primitive turtles possessed two dermal coverings, an inner represented by the carapace and plastron of ordinary turtles, an outer persisting in *Dermochelys* of the present time; that, in all other turtles, the outer has been wholly lost save a few ossicles in *Toxochelys*, while in the latter only vestiges of the inner covering have persisted. Such a development of an outer dermal covering is not impossible, as evidenced by osseous scutes overlying the dermal clavicles in certain lizards, yet one can hardly conceive of a condition in the early reptiles which would bring about the concurrent development of two coverings; certainly we have no warrant in calling the inner